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A New Species of *Cyanus* (Asteraceae, Centaureinae)  
from Southeastern Bulgaria

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**ABSTRACT.** A new species of *Cyanus* Miller, *C. diospolitani* Bancheva & S. Stoyanov (Asteraceae, Centaureinae), from Tundzha hilly country floristic region in Elhovo municipality, southeastern Bulgaria, is described and illustrated. It belongs to *Cyanus* sect. *Napuliferi* (Stefanoff & T. Georgiev) Bancheva & Raimondo, and taxonomically its closest relative is *C. pseudoaxillaris* (Stefanoff & T. Georgiev) Holub, a rare local endemic for the Thracian Plain, Bulgaria. The new species is currently known from four localities in the Derventski Hills (Yambol Province), growing at the periphery of dry, stony meadows in thermophilous oak forests and brushwood. The chromosome number is  $2n = 22$ , and SEM analysis of the pollen grains is described and illustrated.

**Key words:** Asteraceae, Centaureinae, *Cyanus*, IUCN Red List, sect. *Napuliferi*.

During floristic investigation in the Derventski Hills in Elhovo municipality, southeastern Bulgaria (Yambol Province), involving the mapping of priority habitats according to the Natura 2000 criteria (<<http://www.natura.org>>), a new species from *Cyanus* Miller (Asteraceae, Centaureinae) was found. The species has narrowly fusiform roots that shrink upon drying and consequently belongs to *Cyanus* sect. *Napuliferi* (Stefanoff & T. Georgiev) Bancheva & Raimondo (Bancheva & Raimondo, 2003). In contrast to all other perennial *Cyanus*, the new species has branched stems and numerous small capitula.

According to Greuter (2008), *Cyanus* comprises 29 species. Its center of diversity is in Turkey, southeastern Europe, and the Caucasus (Meusel &

Jäger, 1992). *Cyanus* sect. *Napuliferi* includes eight species, seven of which are distributed in Bulgaria. The group is well distinguished by having fusiform or napiform roots, reduced leaf size, and leaf blades that are frequently deeply cut and with white-lanate hairs (Bancheva & Raimondo, 2003).

Living plants of the new species were examined in the field. Morphological characters were noted from herbarium material of personal collections and of the type collection. The karyotype was studied from mitotic metaphase obtained from root tips of three plants collected in the wild from the type locality. Root tips were pretreated with 8-oxychinoline for 30 min., then fixed in acetic alcohol (1:3) for 24 hr. at 4°C, hydrolysed in 1 mol/L HCl for 15 min. at 60°C, stained with hematoxylin according to Gomori (Melandar & Wingstrand, 1953) for 30 min. at 60°C, and squashed in 45% acetic acid. The karyotype has been determined according to Levan et al. (1964) on the basis of eight metaphase plates. The pollen morphology was studied by scanning electron microscopy (SEM) according to Huttunen and Laine's protocol (1983).

***Cyanus diospolitani*** Bancheva & S. Stoyanov, sp. nov. TYPE: Bulgaria. Yambol Prov.: Elhovo mun., Tundzha hilly country floristic region, Derventski Hills, ca. 2 km SW of village of Vulcha Polyana, 41°59'58.9"N, 26°39'26.2"E, 370 m, 23 May 2006, S. Bancheva & S. Stoyanov 163344 (holotype, SOM; isotypes, MO, SOM 163343, W, WU). Figure 1.

Haec species ab affini *Cyano pseudoaxillari* (Stefanoff & T. Georgiev) Holub capitulis numerosis (7 ad 28 nec



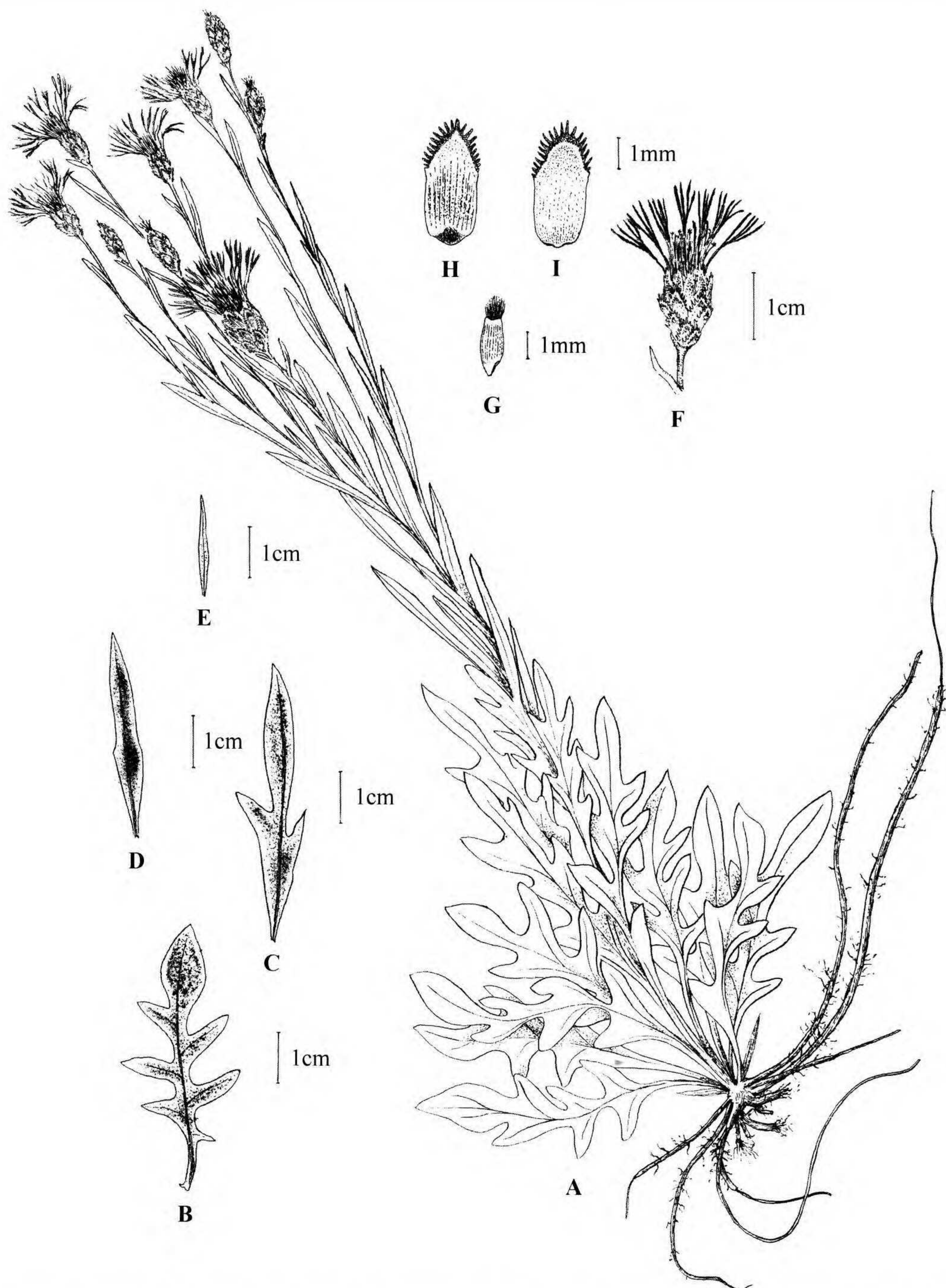


Figure 1. *Cyanus diospolitanius* Bancheva & S. Stoyanov. —A. Habit. —B. Rosette leaf. —C. Lower cauline leaf. —D. Median cauline leaf. —E. Upper cauline leaf. —F. Capitulum. —G. Achene. —H. Median phyllary from the second involucre row. —I. Median phyllary from the third involucre row. Drawn from the holotype Bancheva & Stoyanov 163344 (SOM).



solitario) minoribus angustius cylindricis (5–7[–10] mm nec 13–20 mm latis) atque fimbriis appendicum phyllariorum brevioribus ([0.3–]0.5–0.7[–1] mm nec 2–3 mm longis) differt.

Herbaceous perennial plant; roots 15–20 × 0.6–0.7 cm, narrowly fusiform with very long, slender apices (that shrink upon drying); stems to 70 cm high, erect, branched above the middle, with many capitula (7 to 28). Lower leaves in basal rosette, 13–15 × 3–5 cm, arachno-tomentose, lyrate-pinnatisect, remotely dentate, with 3 lanceolate-triangular, 1.8–3 × 0.8–1 cm teeth on each side; upper stem leaves lanceolate-linear, 3–7 × 0.3–0.4 cm. Capitula small, 13–16 × 5–7(–10) mm; phyllaries triangular-ovoid, arachno-tomentose, green to violet, with decurrent fimbriate margins; appendages triangular-ovoid to ovoid, brown to blackish brown, fimbriate; appendage margin below the fimbriae (0.1–)0.3–0.5(–0.9) mm wide, fimbriae (0.3–)0.5–0.7(–1) mm long. Florets ca. 12–15 mm, purple-violet to cornflower blue; marginal florets longer, radiate, sterile, with linear laciniae ca. 1/2 as long as tube; anther tube of fertile florets exerted, pinkish violet. Achenes asymmetrically cylindrical-truncate, 4–4.5(–5) × 1.5–2 mm, yellowish or pale brown, with lateral elaiosome, ca. 0.5 × 0.3 mm; pappus multiseriate, 1.5–2 mm, pale brown.

*Distribution and ecology.* *Cyanus diospolitani* is currently known from four localities in the Tundzha hilly country of Elhovo municipality in southeastern Bulgaria (Yambol Province), near the villages of Chernozem, Vulcha Polyana, Lesovo, and Malko Kirilovo. The new species was observed to grow at the periphery of dry, stony meadows in thermophilous oak forests and brushwood, at altitudes up to 500 m. It is also likely that *C. diospolitani* would be found in northwestern Turkey, close to the Bulgarian border. This area falls within the Continental climate zone, characterized by a mean January temperature of 1°C, a mean July temperature of 23°C, and an annual precipitation of 500 mm with an autumn–winter maximum (Nikolova et al., 2002). According to the Food and Agriculture Organization of the United Nations (FAO) classification (FAO, 1988), soils such as lithic leptosols (LPq) and chromic luvisols (LVx) are most common in the investigated area (Ninov, 2002).

The Derventski Hills are a Site of Community Importance as part of the European ecological network Natura 2000. The habitat type “Eastern white oak forests–91AA,” where *Cyanus diospolitani* is found, is included in Annex I of the “Habitat” Directive 92/43/EEC.

*Cyanus diospolitani* grows together with *Ajuga laxmannii* (L.) Benth, *Anemone pavonina* Lamarck,

*Astragalus spruneri* Boissier, *Bituminaria bituminosa* (L.) C. H. Stirton, *Bothriochloa ischaemum* (L.) Keng, *Buglossoides arvensis* (L.) I. M. Johnston, *Calepina irregularis* (Asso) Thellung, *Carex caryophyllea* Latourrette, *C. flacca* Schreber, *Carpinus orientalis* Miller, *Cerastium semidecandrum* L., *Chrysopogon gryllus* (L.) Trinius, *Clinopodium vulgare* L., *Clypeola jonthlaspi* L., *Comandra elegans* (Rochel ex Reichenbach) Reichenbach f., *Crataegus monogyna* Jacquin, *Cruciata laevipes* Opiz, *Cyanus thirkei* (Schultz Bipontinus) Holub, *Erysimum diffusum* Ehrhart, *Euonymus verrucosus* Scopoli, *Euphorbia myrsinites* L., *Geranium sanguineum* L., *Helianthemum nummularium* Miller, *Iris pumila* L., *Lathyrus laxiflorus* (Desfontaines) Kuntze, *Leontodon crispus* Villars, *Luzula forsteri* DC., *Mercurialis ovata* Sternberg & Hoppe, *Muscari neglectum* Gussoni ex Tenore, *Ornithogalum fimbriatum* Willdenow, *O. umbellatum* L., *Paliurus spina-christi* Miller, *Paeonia peregrina* Miller, *Polygonatum odoratum* (Miller) Druce, *Potentilla micrantha* Ramond ex DC., *Prunella vulgaris* L., *Quercus cerris* L., *Q. pubescens* Willdenow, *Ranunculus ficaria* L., *R. millefoliatus* Vahl, *Scorzonera mollis* M. Bieberstein, *Sedum hispanicum* L., *Thlaspi perforiatum* L., *Verbascum phoeniceum* L., *V. xanthophoeniceum* Grisebach, *Veronica multifida* L., *Vinca herbacea* Waldstein & Kitaibel, *Viola odorata* L., and *V. sieheana* Becker.

*IUCN Red List category.* According to IUCN Red List criteria (IUCN, 2001), *Cyanus diospolitani* should be classified as Critically Endangered (CR B1ab[i,ii,iii]+2ab[i,ii,iii]). At present, the new species is known from four localities with an area of occupancy about 3 km<sup>2</sup> and an area of distribution about 80 km<sup>2</sup>. The total population is estimated at ca. 800 mature individuals, and the subpopulations are severely fragmented. The major source of threat to the populations is the anthropogenic activity in and around the known collection localities. The felling of the thermophilous oak forests for economic purposes leads to an irreversible loss of the specific habitat to which the species is connected. Some possible measures for conservation of *C. diospolitani* should be taken, such as the creation of a protected area between Lesovo customs house and Vulcha Polyana, with elaboration of an action plan.

*Phenology.* The new species is known to flower in May and fruit in June.

*Karyotype.* 2n = 2x = 18 submetacentric + 4 subtelocentric with satellites = 22. The chromosomes are generally small, ca. 1.5–2 µm (Fig. 2A). The basic chromosome numbers of *Cyanus* known so far are x = 12, 11, 10, 9, and 8 (Hellwig, 2004). The members of



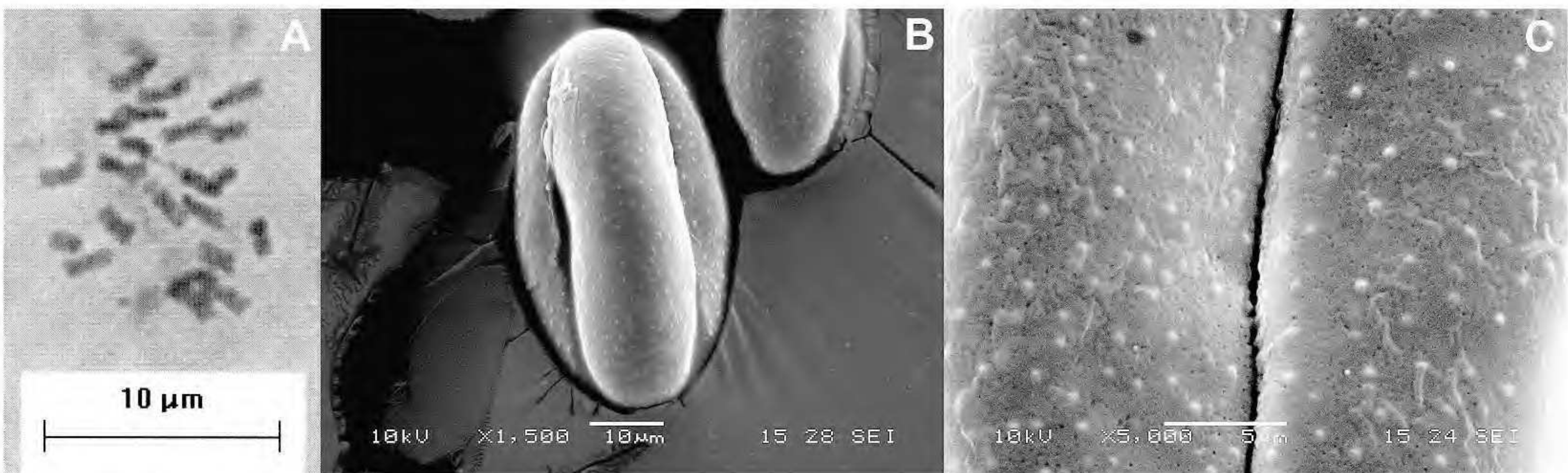


Figure 2. *Cyanus diospolitani* Bancheva & S. Stoyanov. —A. Slide view of metaphase chromosomes,  $2n = 22$ . —B. Pollen grain. —C. Surface detail of pollen grain.

section *Napuliferi* investigated to date have  $x = 11$  and 10. The similar diploid number of  $2n = 22$  has been found in *C. pseudoaxillaris* (Bancheva & Raimondo, 2003).

**Pollen.** Pollen grains are of Wagenitz’s *Centaurea montana* L.-type (1955), prolate, with the correlation of the polar axis to the equatorial diameter of 1.7. The exine sculpture is scabrate, with the density of the sculpture elements being 5 to 8 per  $25\text{ }\mu\text{m}^2$ . Measurements include equatorial diameter  $30 \pm 1.3\text{ }\mu\text{m}$ ; polar axis  $50 \pm 3.2\text{ }\mu\text{m}$ ; mesocolpium  $12.8 \pm 1.6\text{ }\mu\text{m}$ ; apocolpium  $8.5 \pm 1.1\text{ }\mu\text{m}$ ; length of the colpus  $41.5 \pm 3.4\text{ }\mu\text{m}$ ; and breadth of the colpus  $1.6 \pm 0.6\text{ }\mu\text{m}$  (Fig. 2B, C).

**Reproductive biology.** *Cyanus diospolitani* is an outcrossed species that is pollinated by ants and other insects. During field observation, we noticed many drops of a sugary syrup on the borders of the involucrel phyllary appendages, which attracted ants. Ants are also important for the dispersal of the diaspores (myrmecochory). The achenes have well-developed lateral elaiosomes that are rich in oil and are a food source for ants.

**Etymology.** The species epithet refers to Diospolis, the ancient name of the city of Yambol. It is a city in southeastern Bulgaria and the administrative center of Yambol Province, which is the main area of distribution of the new species.

**Relationships.** Based on morphological characters and a basic chromosome number of  $x = 11$ , the closest relative of the new species *Cyanus diospolitani* is *C. pseudoaxillaris*, an equally rare species of very local distribution on the Thracian Plain in Bulgaria. The new species differs from *C. pseudoaxillaris* and from *C. thirkei* (which is found as an associate at the collection localities) by its branched stems, numerous small capitula, and finer fimbriae of the appendages (Table 1).

**Paratypes.** BULGARIA. Yambol Prov.: Elhovo mun., Tundzha hilly country floristic region, Derventski Hills, S of village of Chernozem,  $42^{\circ}05'31.6''\text{N}$ ,  $26^{\circ}35'34.4''\text{E}$ , 24 June 2005, S. Bancheva & S. Stoyanov 163348, 163349 (SOM); NE of Lessovo customs house, 22 May 2006, Bancheva & S. Stoyanov 163345, 163346 (SOM); SE of village of Malko Kirilovo, 16 May 2005, Bancheva & S. Stoyanov 163347 (SOM).

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Table 1. Morphological comparison of the new species *Cyanus diospolitani* with *C. pseudoaxillaris* and *C. thirkei*.

Character	<i>C. diospolitani</i>	<i>C. pseudoaxillaris</i>	<i>C. thirkei</i>
Plant height (cm)	to 70	to 30	5–10(–15)
Root length (cm) and shape	to 20, fusiform	to 20, fusiform	to 2–3, napiform or fusiform
Capitulum number per plant	7 to 28	1	1
Involucre width (mm)	5–7	13–20	16–20
Fimbriae length (mm)	0.5–0.7	2–3	2–3
Color of the florets	purple-violet to cornflower blue	purple-violet	whitish



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